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Caries prevalence of children and adolescents in Bosnia and Herzegovina

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Objective. The aim of this study was to present epidemiological parameters of caries prevalence in children and adolescents in index age groups on a national and regional level in Bosnia and Herzegovina (BH). **Materials and methods.** The study was conducted during 2004 year for children aged 6 and 12, and during 2007 for adolescents aged 15. An oral health survey was performed on a total number of 1,240 children and adolescents in line with World Health Organization methodology and criteria. Results for caries prevalence and treatment needs were presented and discussed in this paper. **Results.** Mean dmft (decay, missing, filled teeth for primary dentition) for children aged six was 6.7 (SD±3.9) in that the decayed teeth constituted the major part of the index (88.8%), followed by extracted teeth (8.9%) and a small percentage of filled teeth (2.3%). In 12-year-olds DMFT (Decay, Missing, Filled Teeth for permanent dentition) was 4.2 (SD±2.9), Significant Caries index (SiC) was 7.7 (SD±2.9), the decayed teeth constituted the major part of the index (45.4%), followed by 42.1% of FT and 12.5% of extracted teeth. Among 15-year-olds the DMFT was 7.6 (SD±4.1), SiC was 9.2 (SD±1.2), and filled teeth constituted the major part of the index. **Conclusion.** The present study provides some evidence of relatively high caries prevalence and severity in comparison with Western European countries. It is necessary to devote more attention to the oral health of children and adolescents. Community based oral health promotion, preventive programs and preventive oriented public dental health care services should be made available and accessible to all children in Bosnia and Herzegovina.

Key words: Oral health, Caries, Children, Epidemiology.

Introduction

Basic epidemiological data are used to collect information about disease prevalence and/or incidence, treatment needs of a population, and to evaluate or monitor efficiency and changes in healthcare systems. The World Health Organization (WHO) provides a specific methodology to collect epidemiological data on oral health parameters through basic oral health surveys, with clear aims to provide a systematic approach to the collection and reporting of data on oral diseases and conditions, and to ensure

that data are comparable with other national surveys (1). WHO recommends conducting periodic national oral health surveys that include monitoring of ten oral health parameters by precisely defined index age groups (1). Most European countries periodically conduct oral health surveys for specific age defined population groups. Recommended age groups in pediatric population to evaluate oral health status are 5 to 6 years, 12 years and 15 years of age (1). Caries, as the most frequent dento-oral disease in children and adolescents, is in the focus of investigations of oral health status for these specific age groups. There is strong agreement that oral health in adults is a reflection of oral health status in childhood (2).

During the past 20 years, many epidemiological studies have revealed a declining trend in the prevalence and severity of oral diseases in Western European countries (3). The first epidemiological study on oral health for the population of Bosnia and Herzegovina (BH) was conducted 27 years ago (4). It was a national oral health survey using WHO methodology, conducted for the population of the former Yugoslav Republics, where BH was included as one of six Yugoslav Republics (4). Due to war and the post-war transitional period in BH, periodic nationwide oral health surveys have not been conducted. Ivankovic (5) conducted an epidemiological study in order to assess the dental health of children aged six and twelve in a part of the region of Herzegovina. There is a lack of data for all three index age groups in BH. Basic epidemiological studies on oral health of the population are necessary to assess morbidity, and to make short-term and long-term plans for the efficient organization and monitoring of the oral-health care system. Previous studies suggested children in BH to be at medium risk for dental caries development, due to bad oral hygiene maintenance, lack of preventive programs, inadequate diet control and frequency, occasional usage of topical fluoridation and changes in living condition (6, 7). Focusing on the oral health of children and adolescents, this study has been conducted to provide baseline epidemiological information of the oral health status of children and adolescents in BH. Partial results of survey have been published previously (6, 8), but results of caries prevalence for all three monitoring groups have not been published before.

The main purpose of this study was to present epidemiological parameters for caries prevalence in children and adolescents on a national and regional level in BH.

Material and methods

Timetable and study groups

The study was conducted during 2004 on children aged 6 and 12 (March, April and May), and during 2007 for adolescents aged 15 (April and May). In BH children are usually enrolled at school by the age of 6 years and have to attend primary school for 9 school years. Therefore, the majority of 12-year -old children were attending the sixth grade. Children aged 15 are in the first or second grade of secondary school, which they have to attend for 4 school years.

Study area

Bosnia and Herzegovina is made up of two entities: the Federation of Bosnia and Herzegovina (FBH) further divided into 10 cantons, and the Republika Srpska (RS). It covers an area of some 51,128 km^2, and has a population of 3,717,130 million people. In 2000, the country had 787 active dentists (6). BH is an area with low natural fluoride content in drinking water (less than 0.1 ppm) and water fluoridation is not yet conducted (6). Fluoride-toothpastes have been available on the market for many years, but studies on the frequency of their usage are lacking.

In 2004, a survey was performed for schoolchildren aged 6 and 12 in 8 locations/ cantons of FBH (Sarajevo, Mostar, Gorazde, Siroki Brijeg, Tuzla, Visoko, Sanski Most and Vitez). In the Republika Srpska a survey was performed in Banja Luka in two locations The age 15 study group were children from the capital, Sarajevo, who were examined at three locations in three different secondary schools. Due to a lack of financial funds, this part of the survey was performed only in Sarajevo, considering the capital as representative of the whole country. The survey was carried out with the agreement of local authorities to perform examinations in schools.

Study sample

The oral health survey was performed on total of 1,240 children and adolescents. There were three study groups, following the index age recommended by WHO (1).

Group 1 consisted of 6-year-old children (mean 6.2, SD±0.9) attending the first grade of primary school. A total number of 560 children were examined in the following survey locations: Sarajevo,as the capital (n=160; 40 examinees on four locations), Tuzla as a large town (n=80; 40 examinees at two locations, Banja Luka as a large town (n=80; 40 examinees at two locations); followed by Mostar, Gorazde, Siroki Brijeg, Visoko, Sanski Most as small towns, but also representatives of cantons, with 40 examinees in each location. Group 2 consisted of 12-year-old children (mean 12.2, SD±0.8) attending the sixth grade of primary school. A total number of 560 children were examined, following the same distribution as the first group. Group 3 consisted of 15-year-olds (mean 15.2, SD±0.5), a total number of 120 examinees (40 examinees in three schools).

Schools were randomly selected, the first class was chosen for investigation (designated A or 1), and children from the next class (designated B or 2) were included if necessary. In each school 40 subjects were examined since the 1997 percentage of 12-year-olds without decayed teeth was 6% (5).

Assessment of oral health

One dental team visited primary schools and clinically examined all subjects in line with WHO methodology and criteria, using dental mirrors and standard CPITN-E periodontal probes, under natural light (1). Parameters used to measure oral health status were: DMFT index, presence of sealants, Community periodontal index (CPI) and developmental defects of enamel index. CPI was performed for ages 12 and 15 (1). For age 15, oral hygiene was estimated by the Plaque Index (PI) by Sillness and Loe (1964) (9), using the same index teeth that were used for CPI, and recording values with the highest score, as recommended for CPI recording. Results for caries prevalence and treatment needs were presented and discussed in this paper, as well as the results of CPI, in relationship to oral hygiene status and caries prevalence.

In the Group 1 (6-year-old children), a survey questionnaire was completed by parents/foster parents one day prior to the examination. The questionnaire included: the number of meals per day, sweet intake, and the number of episodes of tooth brushing per day, the time of first dental visits and frequency of dental visits. Answers were coded for further statistical analyses.

Examinations were performed by two investigators, trained and calibrated for recording the parameters of oral health. Training and calibration was performed on twenty-five 12-year-old subjects, who were not included in the final sample. Kappa statistics were used to test the intra-investigator reliability. The Kappa values estimated from repeat examination for the intra-consistency of the fieldwork investigator were k=0.91, and for inter-examiner reliability 0.89. One ex-

aminer clinically examined 6 and 15-year-old children, and a second examiner did examinations of 12-year-olds. Periodontal status was recorded by using the CPI, according to WHO recommendations for subjects under 20 years of age (1). Prior to the examinations written approval, from the local authorities, schools heads and parents was obtained.

Statistical analysis

Data were coded, noted on a data sheet and later saved electronically. The Statistical Package for Social Science – SPSS for Windows, version 13.0 (SPSS Inc. Chicago, Ill., USA) was used to analyze the data. Results were analyzed with descriptive and analytical statistics. Mean values, standard deviations, percentages and correlations (Spearman's correlation) were computed. The level of significance was defined as $p<0.05$.

Results

The results of caries prevalence of three study groups are given in Table 1

In a total sample of Group 1 the decay teeth component of dmft constituted the major part of the index (88.8%). 34.1% of examinees needed one surface filling on at least one tooth (T1>1.76.8% of examinees needed two or multi surface filling (T2>0), 17.8% needed endodontic treatment (T5>0), and 64.1% needed extraction due to caries (T6>0). 92.5% of examinees needed some kind of dental treatment (T0>0). Results of the mean dmft values in different survey locations are given in Table 2.

Table 1 Caries prevalence in 6, 12 and 15-year-old children

Study groups (n)	Year of study	Parameters of caries prevalence					
		dmft/DMFT ($\bar{X}$±SD)	dt/DT (%)	mt/MT (%)	ft/FT (%)	SiC ($\bar{X}$±SD)	Caries free (%)
Group 1 (560)	2004	6.7±3.8	88.8	8.9	2.3	-	6.8
Group 2 (560)	2004	4.2±2.9	45.4	12.5	42.1	7.7±2.9	9
Group 3 (120)	2007	7.6±4.0	26.4	14.2	59.3	9.2±1.2	2

dmft=decay, missing, filled teeth for primary dentition; DMFT= Decay, Missing, Filled teeth for permanent dentition; dt/DT= decay teeth; mt/MT= missing teeth; ft/FT= filled teeth; SiC= Caries Significance Index (DMFT for 1/3 examinees with the highest DMFT mean values); Caries free= percentages of examinees without caries.

Table 2 Caries prevalence in 6-year-old children in different survey locations

Survey location	Parameters of caries prevalence			
	dmft index	dt % ($\bar{X}$±SD)	mt % ($\bar{X}$±SD)	ft % ($\bar{X}$±SD)
Sarajevo	6.9 ± 4.2	89.3 (6.2±4.2)	7.2 (0.5±1.4)	3.5 (0.7± 0.5)
Banja Luka	7.1 ± 4	91.8 (6.5±3)	6.7 (0.5±0.9)	1.4 (0.4±0.4)
Sanski Most	6.9 ± 4.1	91.9 (6.3±4.2)	7.3 (0.5±1.2)	0.7 (0.3±0.5)
Tuzla	5.9 ± 3.9	90.2 (5.3±3.9)	9.1 (0.5.±1.4)	0.6 (1±02)
Visoko	6.9 ± 3.3	88 (6.1±3)	11.6 (0.8±0.9)	0.4 (0.1±0.2)
Gorazde	8.6 ± 3.2	92.2 (7.9±3.4)	7.8 (0.7±1.5)	0 (0)
Vitez	7 ± 3.8	82.5 (5.6±3.6)	13.6 (1±1.5)	3.9 (1.7±0.3)
Široki Brijeg	6.1 ± 3.3	84.3 (5.4±3.1)	15.6 (0.9±1.6)	0 (0)
Mostar	5.1 ± 2.9	79.2 (3.9±2.7)	9.4 (0.5±1.3)	11.39 (2.2±0.3)

dmft=decay, missing, filled teeth for primary dentition; dt= decay teeth; mt= missing teeth; ft= filled teeth.

In the group of 6-year-olds (Group 1) first permanent molars (FPM) were analyzed as well. In this group 81.7 % of examinees (n=455, mean 3.6±0.9) had all four FPM erupted at the time of recording the dental status. Mean value of DMFT for FPM was 0.6 ±1.1 with the highest value recorded in Gorazde 1.3±1.3, and the lowest value in Banja Luka 0.3±0.7. Mean values for other locations were within this range. Mean values of DMFT components for FPM in all examined locations were less then 1. The average number of FPM with fissure sealants in BH was 0.2±0.8, with the highest values in Siroki Brijeg (0.8±1.5), Sarajevo (0.4±0.9) and Mostar (0.4±1) at the age of six. 20% of examinees needed one surface filling on at least one FPM, and 2% of examinees needed extraction of at least one FPM at the age of six. Further more, some factors possibly associated with caries were analyzed in this study group.

From the total of 560 completed questionnaires that were returned, 344 were filled out correctly for statistical analysis (response rate of 61%). The most participants had 5-6 meals per day (61%), one sweet meal per day (45%), brushing teeth twice a day (60%), and most of them had the first dental visit between the age of 5 and 7 (48%). Spearman's correlation was used to assess the correlation between dmft and the number of meals per day, sweet intake, number of tooth brushings per day and frequency of dental visits. A weak correlation was found between sweet intake and dmft (r=0.13, p=0.31) and between dental visits and dmft (0.13, p=0.31).

Among 12-year-olds (Group 2) the DT-component (decay teeth) constituted the major part of the DMFT (45.4%) (Table 1). In different locations, DMFT was recorded in a range of 2.7 (SD± 2.2) in Sanski Most to 5.4 (SD±2.8) in Široki Brijeg, but the average value for the DT- component of the index was the lowest for Široki Brijeg (0.9±0.8) as well as the FT- component (filled teeth) being the highest (4.3±2.3) for the same location. Results of DMFT at different survey locations are given in Table 3.

Among the examined children, 5.7% had at least one tooth with a fissure sealant. In the total number of 560 examinees and 15,651 recorded permanent teeth, some kind of dental treatment (T0>0) was needed by 99.8% of examinees, fissure sealing (Tf>0) on at least one tooth was needed by 70.8 % of examinees, one surface filling

Table 3 Caries prevalence in 12-year-olds in different survey locations.

Survey location	Parameters of caries prevalence			
	DMFT index	DT % ($\bar{X}$±SD)	MT % ($\bar{X}$±SD)	FT % ($\bar{X}$±SD)
Sarajevo	3.9 ±2.9	43.9 (1.7±2.2)	12.7 (0.5±0.8)	43.4 (1.7±2.1)
Banja Luka	4.8 ± 2.9	50.9 (2.4±2.7)	10.4 (0.5±0.9)	38.7 (1.8±2)
Sanski Most	2.7 ± 2.2	56.5 (1.5±1.6)	18.5 (0.5±0.9)	25 (0.7±1.4)
Tuzla	3.5 ± 2.6	46.2 (1.6±1.7)	16.4 (0.6.±0.9)	37.4 (1.3±1.9)
Visoko	4.5 ± 2.6	65.7 (2.9±2.5)	20.2 (0.9±1.1)	14 (0.6±1.2)
Goražde	4 ± 3.1	46 (1.8±2.1)	16.8 (0.7±1.0)	37.3 (1.5±2.3)
Vitez	4.8 ± 3	45.4 (2.2±2.5)	11.3 (0.5±0.7)	43.3 (2.1±1.8)
Široki Brijeg	5.4 ± 2.8	16.3 (0.9±1.5)	3.2 (0.2±0.4)	80.5 (4.3±2.3)
Mostar	4.3 ± 3.0	42.4 (1.8±2.8)	9 (0.4±0.8)	48.6 (2.1±1.9)

DMFT=Decay, Missing, Filled teeth for permanent dentition; DT= decay teeth; MT= missing teeth; FT= filled teeth.

Table 4 Assessed periodontal condition of 12 and 15-year-olds using CPI

Study groups (n)	Percentage distribution of subjects according to the highest CPI score					
	Healthy	Bleeding	Calculus	Pockets 4-5 mm	Pockets >6 mm	Excluded sextants
Group 2 (560)	43	43	12	-	-	2
Group 3 (120)	18	38	28	14	1	0

(T1>0) by 48.5%, two or multi surface filling (T2>0) by 27.3%, endodontic treatment (T5>0) 13.9% and extraction due to caries (T6>0) by 18.7%.

Among 15-year-olds, the FT component constituted the major part of DMFT (59.3%) (Table 1). Some kind of dental treatment (T0>0) was needed by 78.8% of examinees, fissure sealing (Tf>0) on at least one tooth was needed by 63.3 % of examinees, one surface filling (T1>0) by 37.5%, two or multi surface filling (T2>0) 29.2%, endodontic treatment (T5>0) by 19.4% and extraction due to caries (T6>0) by 14.8%. Periodontal condition was evaluated for children aged 12 and 15 and the results of CPI are given in Table 4, presented as percentages of examinees.

The mean value of PI for 15-year-olds was 1.2 (SD±4), indicating poor oral hygiene (8). The most frequent CPI score in both groups was score 1 (bleeding on probing), indicating gingivitis due to poor oral hygiene. In order to observe score 1 as an indicator of poor oral hygiene status in 12-year-olds, the correlation between mean values of CPI and mean values of PI were analyzed by Spearman's nonparametric correlation. There was a positive correlation between observed parameters of CPI score 2 and PI (r=0.389, p=0.000), indicating that 43% examinees aged twelve, with recorded CPI score 1, possibly had poor oral hygiene as well.

Discussion

This study is the first to present systematically many parameters associated with caries prevalence for all specific index child population groups of Bosnia and Herzegovina. In the research conducted for some parts of Bosnia and Herzegovina in 1997, mean dmft values in children aged six were 4.8, and DMFT for children aged twelve were 6.2 (5). Comparing these figures with the results of the present survey, there was an increase in dmft from 4.8 to 6.7 in the present study and a decrease of DMFT from 6.2 to 4.2. The increase in dmft within seven years could be explained by reduced sugar consumption during the war and the post-war period, but there is no reasonable explanation for the decrease in 12-year-olds.

According to the results of the investigation of caries risk assessment in Bosnian children aged twelve, the majority of Bosnian children were at medium risk for caries development (72%) with just 20% having low caries risk (9). There were significant differences in caries risk in relation to socioeconomic status, where those with a low socioeconomic background had a higher risk of caries development (9).

In the present study, decay contributed the most to the dmft and DMFT for children aged six and twelve, indicating that untreated caries was a problem for the children investigated. According to treatment needs, there is a lack of preventive and curative treatment in primary dentition. FT were the major part of DMFT in adolescents. This reveals a curative approach to caries treatment that obviously begins after the age of six. Treatment needs for children aged 12 and 15, as well as mean DMFT values, indicated a lack of efficient disease prevention.

According to the results of the questionnaire, most participants had their first visit to a dentist between the ages of 5-7 years, and their dental status indicated the lack of any kind of dental treatment. The answers about dietary and oral hygiene habits were in line with preventive guidelines, but epidemiologic figures show a different picture. Fissure sealants, that have contributed in many countries to a decrease in caries incidence (10), had rarely been applied in our population. The results of treatment needs in the age of twelve and fifteen indicate that most young people would have serious dental problems with very possible tooth loss in early adulthood. Thompson et al. (2) concluded that oral health in adulthood was determined by oral health in children. Bleeding and calculus (CPI 1 and CPI 2) were very frequent, not only in adolescents, but also in 12-year-olds, and the mean value of PI >1 in adolescents indicates that poor oral hygiene maintenance is a common problem in our children. The relationship between CPI, PI and DMFT was tested in order to observe CPI score 1 as a possible indicator of oral hygiene level for children aged twelve. Kukletova et al. (11), in an oral health survey of 13-15-year-old adolescents in the Czech Republic, found a significant relationship between gingival index (GI) and DMFT, particularly in the DT component and between PI and gingivitis.

There were some slight differences in epidemiological figures in different survey locations and they were published previously (6). In all survey locations caries prevalence was high and it was far from acceptable. The first nationwide survey according to WHO standards on the prevalence of dental caries from this region (the region of former Yugoslavia) was carried out in 1986 (4). Results showed the prevalence of dental caries in the Yugoslav child population to be very high, with a mean DMFT for 12-year-olds of 6.1 and 9.6 for 15-year-olds. (4) The WHO Oral health database for DMFT of 12-year-olds showed similar results in the past decade for neighboring countries such as Croatia at 4.9, Serbia 7.8, the Former Yugoslav Republic Macedonia 3.0 and Slovenia 1.8 (12). Slovenia was the only former Yugoslav country where a remarkable decrease in caries prevalence was recorded (12, 13). The notable improvement of dental health in Slovenian children was explained by the estabilishment of preventive programmes, with the stress on supervised teeth brushing with concentrated fluoride gel in primary schools, improved oral hygiene, and a comprehensive programme of applying fissure sealants, particularly on first molars (13).

Declining trends in caries prevalence of children and adolescents have been reported in many European countries (3, 10, 14-16). Following WHO methodology made it possible to compare our findings with other national surveys. In 1979, the World Health Assembly accepted an important goal for oral health in children: the average DMFT in 12-year-old children should be no greater than 3.0, and 50% of children aged six had to be caries free (17). By 1995, the average DMFT for children aged twelve in six Western European Countries (Denmark, Finland; Ireland, the Netherlands, Sweden and the United Kingdom) had fallen below 2.0 (14). Twelve-year-olds represent a standard age category used by WHO to assess and compare dental caries levels in permanent dentition of children worldwide (3, 18). The mean dmft varies between 1.5 in England and Greece and 0.8 in Denmark (3). For the 15-year-olds, mean values of DMFT were in a range from 3.19 in England to 1.48 in Wales, and the lowest percentage of caries free was in Denmark at 42% (3). Findings of the present study were higher than 3.0, and for 12-year-olds at least twice as high as in Western European countries, and the percentage of caries free children aged six was 6.8. Furthermore, the SiC for

12 and 15-year-olds was twice as high as the mean DMFT. By definition, the SiC is part of DMFT, calculated on one third of population with the highest caries scores (17) and it is always higher than DMFT, but in this case it is a cause of great concern. It is obvious that BH is a country with relatively high caries prevalence. Further investigations should concentrate on revealing the specific factors that influence such oral health neglect.

Conclusions

The present study provides evidence of relatively high caries prevalence and severity in comparison with Western European countries. It is urgent to devote more attention to the oral health of children and adolescents. Poor oral health is not only a health problem, it is also a social problem. Realistic goals have to be set and oral health programs should be created and implemented for children and adolescents for the entire population, but also for high risk groups. Community based oral health promotion, preventive programs and preventive oriented public dental health care services should be made available and accessible to all BH children.

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